DESCRIPTION

INSTRUMENT PANEL IMAGE DISPLAY DEVICE, INSTRUMENT PANEL IMAGE CHANGING METHOD, VEHICLE, SERVER, INSTRUMENT PANEL IMAGE CHANGING SYSTEM, INSTRUMENT PANEL IMAGE DISPLAY PROGRAM, COMPUTER-READABLE STORAGE MEDIUM STORING INSTRUMENT PANEL IMAGE DISPLAY PROGRAM

TECHNICAL FIELD

The present invention relates to an instrument panel image display device, an instrument panel image changing method, a vehicle, a server, an instrument panel image changing system, an instrument panel image display program, a computer-readable storage medium storing the instrument panel image display program, whereby it is possible to change a displayed instrument panel image into other instrument panel image.

BACKGROUND ART

Recently, there have been widely used instrument panels, installed on vehicles such as automobiles, each of which causes a liquid crystal panel or the like to display an instrument panel image. In such a display, there is displayed an instrument panel

image constituted of various gauge-like images such as a speedometer image, a tachometer image, a fuel gauge-like image, and the like.

However, the conventional instrument panel raises such a problem that a driver cannot change the displayed instrument panel image.

In order to solve the problem, Japanese Unexamined Patent Publication No. 297318/1998 (Tokukaihei 10-297318)(published on November 10, 1998) discloses an instrument panel image selection device which includes: storage means for storing plural sets of instrument panel image data; selection means for selecting instrument panel image data, corresponding to a selection operation, from the plural sets of instrument panel image data, so as to generate a selection signal thereof; and instrument panel image data output means for outputting instrument panel image data, selected from the plural sets of instrument panel image data, which corresponds to the selection signal, to the instrument panel image display means.

According to Tokukaihei 10-297318, when the foregoing device is used, it is possible that the driver selects a desired instrument panel image and causes the instrument panel image display means to display thus selected instrument panel image. Similar techniques are disclosed by Japanese Unexamined Patent Publication No.

297392/1998 (Tokukaihei 10-297392)(published on November 10, 1998), Japanese Unexamined Patent Publication No. 308136/1998 (Tokukaihei 10-308136)(published on November 17, 1998), Japanese Unexamined Patent Publication No. 297319/1998 (Tokukaihei 10-297319)(published on November 10, 1998), Japanese Unexamined Patent Publication No. 57730/1991 (Tokukaihei 3-57730)(published on March 13, 1991), and Japanese Unexamined Patent Publication No. 095040/2003 (Tokukai 2003-095040)(published on April 3, 2003).

However, each of the foregoing conventional techniques raises such a problem that an instrument panel image is not so freely selected.

That is, according to the foregoing conventional techniques, the driver can simply change an entire instrument panel image to other instrument panel image. Thus, even when the driver wants to select a new instrument panel image obtained by combining a speedometer image of an instrument panel image with a tachometer image of another instrument panel image for example, such operation is not allowed. That is, the driver cannot combine desired gauges with each other so as to make an original instrument panel image and display the original instrument panel image.

DISCLOSURE OF INVENTION

An object of the present invention is to provide: an instrument panel image display device which allows an instrument panel image to be more freely selected with visibility of gauges taken into consideration; an instrument panel image changing method; an instrument panel image display program; and a computer-readable storage medium storing the instrument panel image display program.

Further, an object of the present invention is to provide: a vehicle including the foregoing instrument panel image display device; and a server for providing image data, which codes a replacing gauge-like image, to the instrument panel image display device.

Moreover, an object of the present invention is to provide an instrument panel image changing system including the instrument panel image display device and the server.

In order to solve the foregoing problem, an instrument panel image display device according to the present invention is an instrument panel image display device, installed on an apparatus so as to display an instrument panel image, and the instrument panel image display device includes: display means for displaying the instrument panel image including a gauge-like image, by which internal and external information of the apparatus is provided to a user, in accordance with image data which codes the gauge-like

image; and image data changing means for changing the image data, which codes the gauge-like image, into image data, which codes other gauge-like image.

The present device is installed on an apparatus, such as a vehicle or the like for example, which includes a gauge panel. Further, the present device is provided with an instrument panel constituted of a liquid crystal display or the like for example, thereby digitally displaying an instrument panel image.

Further, an instrument panel image displayed in the present device includes plural gauge-like images, such as a speedometer image and a tachometer image, each of which notifies a user about internal and external information of the apparatus having the present device. Further, each of these gauge-like images is coded by image data. That is, in the present device, the display means causes the instrument panel to display each of gauge-like images coded by plural sets of image data, thereby displaying an entire instrument panel image including the plural gauge-like images.

Here, in the present device, the image data changing means does not change the image data, which codes the entire instrument panel image, into other instrument panel image, but changes image data, which codes each gauge-like image included in the instrument panel image, into image data, which codes other gauge-like image. That is, the present device is arranged so that: changeable

gauge-like images are combined with each other so as to display an instrument panel image having a new arrangement that has not been prepared in advance. On this account, the present device gives such an effect that it is possible to more freely select an instrument panel image.

Further, an instrument panel image changing method (present method) according to the present invention is a method of changing an instrument panel image displayed in an instrument panel image display device installed on an apparatus, and the method includes the steps of: displaying the instrument panel image including a gauge-like image, by which internal and external information of the apparatus is provided to a user, and a background image, which serves as a background of the gauge-like image, in accordance with image data which codes the gauge-like image and image data which codes the background image; and changing the image data, which codes the background image, into image data, which codes other background image.

According to this arrangement, the present method gives the same effect as the aforementioned present device.

Further, an instrument panel image display device according to the present invention is an instrument panel image display device, installed on an apparatus so as to display an instrument panel image, and the instrument panel image display device

includes: display means for displaying the instrument panel image including a gauge-like image, by which internal and external information is provided to a user, and a background image, which serves as a background of the gauge-like image, in accordance with image data which codes the gauge-like image and image data which codes the background image; and image data changing means for changing the image data, which codes the background image, into image data, which codes other background image.

The present device is installed on an apparatus, such as a vehicle, which includes a gauge panel. Further, the present device is provided with an instrument panel such as a liquid crystal panel for example, thereby digitally displaying an instrument panel image.

Further, an instrument panel image displayed in the present device includes: a plurality of gauge-like images, such as a speedometer image and a tachometer image, each of which notifies a user about internal and external information of the apparatus having the present device; and a background image which serves as a background of the gauge-like images. Further, each of the gauge-like image and the background image is coded by image data. That is, in the present device, the display means causes an instrument panel to display the gauge-like images and the background image that are coded by plural sets of image data,

thereby displaying an entire instrument panel image, having the gauge-like images and the background image, in the instrument panel.

Here, in the present device, the image data changing means does not change image data, which codes the entire instrument panel image, into other instrument panel image, but changes image data, which codes a background image included in the instrument panel image, into image data, which codes other background image. That is, the present device is arranged so that: a new background image and gauge-like images are combined with each other so as to display an instrument panel image having a new arrangement that has not been prepared in advance. On this account, the present device gives such an effect that it is possible to more freely select an instrument panel image.

Further, an instrument panel image changing method (present method) according to the present invention is a method of changing an instrument panel image displayed in an instrument panel image display device installed on an apparatus, and the method includes the steps of: displaying the instrument panel image including a gauge-like image, by which internal and external information of the apparatus is provided to a user, and a background image, which serves as a background of the gauge-like image, in accordance with image data which codes the gauge-like image and image data which

codes the background image; and changing the image data, which codes the background image, into image data, which codes other background image.

According to this arrangement, the present method gives the same effect as the aforementioned present device.

For a fuller understanding of the nature and advantages of the invention, reference should be made to the ensuing detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a block diagram illustrating an arrangement of an instrument panel image display device according to one embodiment of the present invention.

Fig. 2 illustrates, in detail, gauge-like image data, background image data, and thumbnail image data that are included in an image database.

Fig. 3 illustrates an example of a type of a parameter correction table stored in a correction database.

Fig. 4 illustrates an example of correction values included in the parameter correction table.

Fig. 5 illustrates an example of how various gauge-like images are disposed in an instrument panel image.

Fig. 6 illustrates a condition under which an instrument panel

displays an image for allowing a user to select a speedometer image.

Fig. 7(a) illustrates an example where the speedometer image is corrected, and illustrates an instrument panel image in which an uncorrected speedometer image is disposed.

Fig. 7(b) illustrates an example where the speedometer image is corrected, and illustrates an instrument panel image in which a corrected speedometer image is disposed.

Fig. 8 illustrates an example of areas which can be occupied by various gauge-like images disposed in an instrument panel image.

Fig. 9(a) illustrates an example where display states of various gauge-like images displayed in an instrument panel image are changed, and illustrates an example of a condition immediately after changing the instrument panel image.

Fig. 9(b) illustrates an example where display states of various gauge-like images displayed in an instrument panel image are changed, and illustrates areas which can be occupied by a navigator image and a speedometer image in the instrument panel image.

Fig. 9(c) illustrates an example where display states of various gauge-like images displayed in an instrument panel image are changed, and illustrates a condition under which a corrected

navigator image and a corrected speedometer image are disposed in the instrument panel image.

Fig. 10(a) illustrates an example where a display state of the speedometer image is corrected, and illustrates a speedometer image whose display state has not been adjusted or corrected.

Fig. 10(b) illustrates an example where a display state of the speedometer image is corrected, and illustrates a speedometer image whose image size has been changed.

Fig. 10(c) illustrates an example where a display state of the speedometer image is corrected, and illustrates an instrument panel image having a speedometer image whose speed graduations are changed in terms of size.

Fig. 10(d) illustrates an example where a display state of the speedometer image is corrected, and illustrates an instrument panel image having a speedometer image whose speed graduations are changed in terms of size by means of a parameter correction section.

Fig. 11 is a block diagram for illustrating, in detail, an arrangement of an instrument panel image changing system which includes: a server having a storage section for storing at least either gauge-like image data or background image data; and an instrument panel image display device which obtains at least either replacing gauge-like image data or replacing background image data

from the server.

Fig. 12 is a flow chart for schematically illustrating operations in a background image changing mode.

Fig. 13 illustrates how to determine a standard color used to monotonize a background image.

Fig. 14 is a flowchart for schematically illustrating a process for changing a background image into a monotone image by using a doubletone based on a color mainly used in the background image.

Fig. 15 is a flowchart for schematically illustrating a process for changing a background image into a monotone image by using a doubletone based on a color, out of colors mainly used in the background image, in case where a combination of the color and a letter color of the gauge-like image is not a combination which has been forbidden in advance.

Fig. 16 is a flowchart for schematically illustrating a luminance correction process carried out with respect to the background image.

Fig. 17 is a flowchart for schematically illustrating a bordering process carried out with respect to the gauge-like image.

Fig. 18 illustrates an example of a color table which indicates a relationship between the letter color of the gauge-like image and a bordering color.

BEST MODE FOR CARRYING OUT THE INVENTION

One embodiment of the present invention is described below with reference to Fig. 1 through Fig. 18.

Fig. 1 is a block diagram for illustrating an arrangement of an instrument panel image display device 1 according to one embodiment of the present invention. Fig. 1 schematically illustrates a condition under which the instrument panel image display device 1 includes an instrument panel 2, an operation section 4, a reserve data storage section 6, and an image data changing section 10.

The instrument panel 2 is a panel-type display which displays an instrument panel image coded by instrument panel image data. As the instrument panel 2, a liquid crystal panel may be used for example.

Here, the instrument panel image displayed in the instrument panel 2 includes a plurality of “gauge-like images”, categorized into various information such as a speedometer, a tachometer, an engine thermometer, a fuel gauge, various kinds of warning lights such as a seatbelt warning light, a shift indicator (indicative of a gear state), an indicator, a navigation for showing a map, a Web window for indicating a Web site, a speed graph display, a speed value display, a turn signal, and surrounding information of a vehicle (including information of the vehicle itself) and information

of internal condition of the vehicle, that is, each of which notifies a driver about various internal and external information of an apparatus having the present device. That is, the instrument panel image provides information indispensable or beneficial in the driving or entertainment information to the driver. Further, the instrument panel image displayed in the instrument panel 2 includes a “background image” which serves as a background of the gauge-like images. That is, the instrument panel 2 displays an instrument panel which includes the gauge-like images and the background image.

These various kinds of gauge-like images are respectively disposed in specific positions of the instrument panel image. For example, as will be described later, a speedometer image for displaying a running speed of the vehicle is disposed in the instrument panel image so as to be positioned in front of the driver or on the side of the driver. That is, the speedometer image is positioned within a range which has been most appropriately determined in advance so as to be covered by a visual field of the driver. Note that, the instrument panel may be disposed in a center of a dashboard depending on a type of the vehicle. Further, a position in which each gauge-like image is disposed is predetermined according to a category to which the gauge-like image belongs. However, as will be described later, it is possible to

change the position.

Note that, it is not necessary that the instrument panel image displayed in the instrument panel 2 includes all kinds of these gauge-like images. For example, the instrument panel image includes at least four kinds of the aforementioned gauge-like images. However, for the sake of the security of the driver, the instrument panel image includes gauge-like images which respectively indicate at least the speedometer, the turn signal, the fuel gauge, and the engine thermometer.

Further, the instrument panel data which codes the instrument panel image displayed in the instrument panel 2 includes plural sets of gauge-like image data (image data) which respectively code these gauge-like images. Further, it is not necessary that the instrument panel image data for coding the instrument panel image includes all the kinds of the aforementioned gauge-like images. That is, any data may be used as the instrument panel image data as long as the data codes the gauge-like image actually displayed in the instrument panel 2.

As will be described later, the instrument panel image display device 12 changes each of various gauge-like images included in the displayed instrument panel image into other image which belongs to the same category of that gauge-like image. For example, the instrument panel image display device 1 can change an

analog-display-type speedometer into a digital-display-type speedometer.

This can be realized by changing the gauge-like image data, which codes the gauge-like image, into other gauge-like image data, which belongs to the same category of that gauge-like image data, (by carrying out the step of changing the image data) in the instrument panel image display device 1.

Further, the instrument panel image display device 1 allows the driver to change the display states of various gauge-like images. This can be realized, in the instrument panel image display device 1, by changing a parameter which defines a display state of each gauge-like image.

Note that, the parameter is included in each gauge-like image data. Further, for example, the parameter defines at least one of (i) a size of the gauge-like image, (ii) a color of the gauge-like image, (iii) which part of the instrument panel image the gauge-like image is positioned in, (iv) a size of a font included in each gauge-like image, (v) a color of the font, and (vi) which part of the gauge-like image the font is positioned in, (vii) and the like.

Thus, the instrument panel image display device 1 can change a value indicative of a running speed of the vehicle and a size of a bar indicative of the running speed or a color of the bar, all of which are included in the analog-display-type speedometer, by

changing the parameter which defines the display state of the speedometer image for example.

Detail descriptions thereof will be given later.

The operation section 4 is used by the driver, and allows the instrument panel image display device 1 to be operated. The instrument panel image display device 1 changes at least one of the gauge-like image and the background image, which are displayed in the instrument panel 2, or changes the display state thereof, in accordance with various instructions inputted via the operation section 4. Further, it may be so arranged that: the operation section 4 is an input device such as a mouse, a keyboard, a switch, a touch panel, and the like, and instructions are inputted thereto in accordance with the image change I/F which is displayed via an image data changing control section 11, the image display section 17, and the instrument panel 2.

The reserve data storage section 6 stores at least either reserve data of various gauge-like images (gauge-like image data) or reserve data of a background image (background image data). Here, the gauge-like image data is indicative of a gauge-like image displayed in the instrument panel 2 and the background image data is indicative of a background image displayed in the instrument panel 2. Ordinarily, upon beginning the operation, the instrument panel image display device 1 uses the data, stored in the reserve

data storage section 6, which corresponds to at least either reserve gauge-like images or a reserve background image, thereby causing the instrument panel 2 to display an instrument panel image displayed at the time of ordinary operation.

The image data changing section 10 changes the gauge-like image, displayed in the instrument panel 2, into other gauge-like image, or changes the background image, displayed in the instrument panel 2, into other background image, or carries out both the changing operations. Further, the image data changing section 10 has a function for changing a display state of at least either the gauge-like image or the background image.

An object of the present instrument panel image display device 1 is to enable an instrument panel image displayed in the instrument panel 2 to be more freely selected. In order to achieve the object, the present instrument panel image display device 1 is characterized particularly by the image data changing section 10. The following description details an arrangement, an action, and an effect of the image data changing section 10. Note that, the instrument panel image display device 1 is installed on a vehicle.

As illustrated in Fig. 1, the image data changing section 10 includes an image data changing control section 11, a reserve data obtaining section 12, a thumbnail image data obtaining section 13, a gauge-like image data obtaining section 14, a parameter

correction section (parameter judging means, parameter changing means) 15, a parameter adjusting section (parameter changing means) 16, an image display section (display means) 17, an image database 21, and a correction database 22.

The image data changing control section 11 controls the entire operations of the image data changing section 10. For example, the image data changing control section 11 receives a signal inputted from the operation section 4, and outputs the signal or data to various kinds of members described later.

The image data changing control section 11 includes a memory (not shown). The memory temporarily stores data of at least either various gauge-like images or the background image that have been obtained from the reserve data storage section 6 via the reserve data obtaining section 12 described later.

The reserve data obtaining section 12 accesses the reserve data storage section 6, and obtains data of at least either the reserve gauge-like images or the reserve background image. Further, the reserve data obtaining section 12 has a function for writing at least either the reserve gauge-like images or the reserve background image onto the reserve data storage section 6.

The thumbnail image data obtaining section 13 accesses the image database 21, and obtains the thumbnail image data. The thumbnail image data codes a thumbnail image indicating at least

either the gauge-like image or the background image in a small size. Further, as will be described later, the thumbnail image data is used by the image display section 17 in causing the instrument panel 2 to display an image which allows the driver to select at least either the replacing gauge-like image or the replacing background image.

The gauge-like image data obtaining section 14 accesses the image database 21, and obtains data of at least either the gauge-like image or the background image (gauge-like image data, background image data). As described above, the gauge-like image data is data which codes each gauge-like image included in the instrument panel image. Further, as described above, the background image data is data which codes the background image included in the instrument panel image. Note that, the background image data may be generated by combining plural sets of data.

Note that, the gauge-like image data obtaining section 14 uses an identifier indicated by an identifier signal generated by the image data changing control section 11, thereby obtaining the gauge-like image data, which codes a gauge-like image selected by the driver, or the background image data, which codes a background image selected by the driver, or both the data, from the image database 21. This will be detailed later.

The parameter correction section 15 corrects a parameter

which defines a display state of at least either various gauge-like images or background image. At this time, the parameter correction section 15 uses a parameter correction table for correcting at least data of the gauge-like image or data of the background image that are stored in the correction database 22. This table will be detailed later.

Further, the parameter correction section 15 uses an identifier indicated by an identifier signal generated by the image data changing control section 11, thereby specifying and obtaining a correction parameter value, applicable to at least either the gauge-like image data or the background image data targeted in the correction, from the correction database 22. This will be detailed later.

The parameter adjusting section 16 changes a parameter, which defines a display state of at least either the gauge-like image or the background image, in accordance with a value inputted by the driver via the operation section 4.

The image display section 17 causes the instrument panel 2 to display a gauge-like image coded by the gauge-like image data and a background image coded by the background image data. Further, in order to schematically show the gauge-like image and the background image, the image display section 17 has a function for displaying a thumbnail image, coded by thumbnail image data, in

the instrument panel 2.

The image database 21 is a database for storing the gauge-like image data which codes the gauge-like image such as a speedometer and the background image data which codes the background image with them respectively related to identifiers and corresponding thumbnail images.

The image database 21 is detailed as follows with reference to Fig. 2. Fig. 2 details the gauge-like image data and the background image data that are stored in the image database 21. As illustrated in Fig. 2, the image database 21 stores, for example, a background database, or a sub-database (such as a speedometer image database) for storing sets of gauge-like image data which belong to the same category.

Here, each of these sub-databases stores each gauge-like image data with it related to an identifier and corresponding thumbnail image data. For example, as illustrated in Fig. 2, the background image database stores background image data 1 to n (n is a positive integer) with thumbnail image data SNH1 to SNHn each of which codes a thumbnail image of each image. Further, although not shown particularly, in the background image database, the gauge-like image data is related to an identifier corresponding to the image data.

Likewise, the speedometer database stores speedometer image

data 1 to n with thumbnail image data SNS1 to SNSn each of which codes a thumbnail image of each image. Here, also in the speedometer database, the stored gauge-like image data is related to an identifier corresponding to the image data.

In this manner, each of the thumbnail image data obtaining section 13 and the gauge-like image data obtaining section 14 uses an identifier, thereby specifying and obtaining the thumbnail image data, the gauge-like image data, and the background image data, that should be obtained, from the image database 21. This will be detailed later.

The correction database 22 is a database, used to correct a parameter for defining a display state of at least either the gauge-like image or the background image, which stores a parameter correction table. The correction database 22 is detailed as follows with reference to Fig. 3 and Fig. 4.

Fig. 3 details the parameter correction table included in the correction database 22. As illustrated in Fig. 3, the correction database 22 stores, for example, a navigator correction table, or various kinds of parameter correction tables such as a speedometer correction table and the like. Note that, kinds of the parameter correction table are not limited to them, but the correction database 22 may include the parameter correction table corresponding to other gauge-like image and other background

image that are displayed in the instrument panel 2.

Further, as illustrated in Fig. 3, the parameter correction table stores various kinds of sub-tables such as a position table, a color table, a letter color table, and the like. Each of these sub-tables stores correction values used to correct various kinds of parameters each of which defines a display state of at least either the gauge-like image or the background image.

These sub-tables are described as follows with reference to Fig. 4. Fig. 4 illustrates an example of the parameter correction table included in the correction database 22.

As illustrated in Fig. 4, in the parameter correction table, there are sub-tables so as to respectively correspond to parameters for defining display states of gauge-like images, for example, a position of each gauge-like image, a size of the gauge-like image, a color of the gauge-like image, a size of a letter included in the gauge-like image, and a letter color. As illustrated in Fig. 4, each of these sub-tables includes: an allowable range within which a value of the parameter can increase or decrease; a standard value; and recommendable values 1 to n selected in correcting the parameter.

Note that, a specific example where the display state of the gauge-like image is corrected by using the correction database 22 will be described later.

The following description will detail how the instrument panel

image display device 1 operates (gauge-like image changing mode). Note that, how the instrument panel image display device 1 changes the background image (background image changing mode) will be detailed later.

First, at the time of an ordinary operation, an "image changing" button is displayed in the instrument panel 2. When the driver presses the button via the operation section 4, the instrument panel image display device 1 shifts its mode to the gauge-like image changing mode. Specifically, when the "image changing" button is pressed, the operation section 4 outputs a reserve data obtainment request signal to the image data changing control section 11.

When the reserve data obtainment request signal is inputted, the image data changing control section 11 outputs the signal to the reserve data obtaining section 12. As a result, the reserve data obtaining section 11 accesses the reserve data storage section 6, and obtains stored various kinds of gauge-like image data for display. Further, the reserve data obtaining section 12 outputs thus obtained gauge-like image data to the image data changing control section 11.

The image data changing control section 11 which has received the gauge-like image data stores the data into a memory (not shown). Further, the image data changing control section 11

outputs a gauge-like image changing mode shift signal to the image display section 17. The image display section 17 which has received the signal changes an image displayed in the instrument panel 2 into an image which allows a category of a replacing gauge-like image to be selected. For example, the image display section 17 displays a message such as "Select a category of a replacing image" in an upper position of the instrument panel 2.

Next, the driver selects an image, which belongs to a certain category, out of various gauge-like images displayed in the instrument panel 2. In this case, for example, the driver operates the operation section 4 so as to select one of the gauge-like images displayed in the instrument panel 2. In case where a mouse or the like is used, one of the gauge-like images is double-clicked. As a result, the operation section 4 outputs a category identification signal, indicative of a category (a speedometer, a tachometer, and the like) to which a replacing gauge-like image belongs, to the image data changing control section 11.

The image data changing control section 11 which has received the category identification signal analyses the signal, and specifies a category to which the target gauge-like image belongs. In accordance with a result of the specifying operation, the image data changing control section 11 generates an identifier signal related to thumbnail image data which codes a thumbnail image of a

gauge-like image belonging to the category which has been selected by the driver. Further, the image data changing control section 11 outputs thus generated identifier signal to the thumbnail image data obtaining section 13.

The thumbnail image data obtaining section 13 which has received the identifier signal accesses the image database 21. Further, the thumbnail image data obtaining section 13 obtains the thumbnail image data from the image database 21 by using an identifier indicated by the identifier signal. The thumbnail image data obtained at this time codes a thumbnail image corresponding to a selectable gauge-like image in a category, selected by the driver, to which the replacing gauge-like image belongs. Note that, the thumbnail image data obtaining section 13 outputs thus obtained thumbnail image to the image data changing control section 11.

When the thumbnail image data is inputted, the image data changing control section 11 outputs thus inputted data to the image display section 17. Further, the image display section 17 uses thus inputted thumbnail data so as to display an image, which allows the driver to select a replacing gauge-like image, in the instrument panel 2. At this time, the instrument panel 2 displays the thumbnail image as illustrated in Fig. 6 for example.

Thereafter, the driver determines which image is to be displayed, out of various gauge-like images, displayed in the

instrument panel 2, which are indicated by thumbnail images. Specifically, for example, the driver double-clicks any one of thumbnail images, displayed in the instrument panel 2, via the operation section 4. Thus, the operation section 4 outputs an image identification signal, indicating a kind of the replacing gauge-like image, to the image data changing control section 11.

When the image identification signal is inputted, the image data changing control section 11 analyses the signal and specifies the replacing gauge-like image. In accordance with a result of the specifying operation, the image data changing control section 11 generates an identifier signal related to gauge-like image data which codes the gauge-like image selected by the driver. Further, the image data changing control section 11 outputs thus generated identifier signal to the gauge-like image data obtaining section 14.

When the identifier signal is inputted, the gauge-like image data obtaining section 14 accesses the image database 21. Further, the gauge-like image data obtaining section 14 obtains the gauge-like image data from the image database 21 by using an identifier indicated by the identifier signal. The gauge-like image data obtained at this time codes a replacing gauge-like image selected by the driver. The gauge-like image data obtaining section 14 outputs thus obtained gauge-like image data to the image data changing control section 11.

When the gauge-like image data is inputted, the image data changing control section 11 outputs the data to the image display section 17. Further, the image display section 17 updates the image displayed in the instrument panel 2 by using thus inputted gauge-like image data. Specifically, the image display section 17 replaces a gauge-like image with a gauge-like image, belonging to the same category as that gauge-like image, which is coded by the inputted gauge-like image data, so as to display a new gauge-like image (display step).

The foregoing process enables the gauge-like image displayed in the instrument panel 2 to be changed. At this time, the instrument panel 2 displays an image, which allows the driver to select a category of a replacing gauge-like image, again. Thus, the driver can separately change gauge-like images belonging to various categories by selecting a gauge-like image belonging to a different category.

In other words, the instrument panel image display device 1 does not change image data, which codes the entire instrument panel image, into other instrument panel image, but changes image data, which codes each gauge-like image in the instrument panel image, into image data, which codes other gauge-like image. That is, the instrument panel image selectable by the driver can be generated by combining gauge-like images coded by various

gauge-like image data prepared in the image database 21. Thus, it is possible to select an instrument panel image, having a new arrangement which has not been prepared in advance, by combining changeable gauge-like images with each other. Thus, it is possible to more freely select an instrument panel image. For example, in case where there are eight categories of gauge-like images and there are five gauge-like images which can be selected in each category, there are theoretically 1,953,125 patterns as instrument panel images which can be displayed in the instrument panel.

Here, the present instrument panel image display device 1 can not only change a displayed gauge-like image into other image but also adjust a display state of the gauge-like image. For example, the instrument panel image display device 1 can change a size, a color, and a position of each gauge-like image in the instrument panel image. This is described as follows.

First, the driver selects a gauge-like image for adjusting the display state via the operation section 4. For example, the driver selects one of gauge-like images displayed in the instrument panel 2 and presses an “adjustment” button. As a result, the operation section 4 outputs an adjusted image identification signal, which specifies a gauge-like image whose display state is to be changed, to the image data changing control section 11.

When the adjusted image identification signal is inputted, the

image data changing control section 11 specifies gauge-like image data, which codes a gauge-like image whose parameter is to be adjusted, in accordance with the signal. Further, the image data changing control section 11 accesses a memory (not shown) and reads out the gauge-like image data whose parameter is to be adjusted. Further, the image data changing control section 11 specifies kinds (size, color, position, and the like) indicated by various parameters for specifying a display state of the gauge-like image included in the gauge-like image data that has been read out. In accordance with a result of the specifying operation, the image data changing control section 11 outputs a signal, indicative of a kind of the specified parameter, to the image display section 17.

When the signal is inputted, the image display section 17 displays an image, allowing the driver to input a parameter value which should be changed, in the instrument panel 2. Here, the driver inputs a parameter value, which defines a display state of the displayed gauge-like image, via the operation section 17. For example, the driver inputs a vertical size and a horizontal size of the gauge-like image via the operation section 4. Further, the operation section 4 which has received the sizes outputs the value, inputted by the driver, to the image data changing control section 11.

The image data changing control section 11 which has

received the value outputs the value and gauge-like image data, whose parameter is to be adjusted, to the parameter adjusting section 16. When the data and value are inputted, the parameter adjusting section 16 rewrites the parameter included in the gauge-like image data into the inputted value. Further, the parameter adjusting section 16 outputs the gauge-like image data, whose parameter has been rewritten, to the image data changing control section 11.

When the data is inputted, the image data changing control section 11 writes the inputted data into a memory (not shown). Further, the image data changing control section 11 outputs the data to the image display section 17. Further, the image display section 17 uses the gauge-like image data, whose parameter has been changed, so as to update an image displayed in the instrument panel 2. Thus, the instrument panel 2 displays a gauge-like image whose display state has been changed according to the value inputted by the driver.

Further, the aforementioned adjustment of the image display state is repeatedly carried out with respect to respective gauge-like images in the instrument panel image, so that display states of various gauge-like images displayed in the instrument panel 2 are respectively changed according to values inputted by the driver.

That is, the instrument panel image display device 1 can

change a display state of a gauge-like image displayed in the instrument panel 2 by changing a value of a parameter, which defines a display state of an image indicated by the gauge-like image data, into other value (value inputted by the driver). Thus, the instrument panel image display device 1 displays a gauge-like image, whose display state has been set as the driver likes, in the instrument panel 2. Thus, according to the instrument panel image display device 1, it is possible to much more freely select a displayed instrument panel image without dropping the visibility.

When the adjustment of the display state of the gauge-like image is completed, the driver presses a "Finished" button, displayed in the instrument panel 2, via the operation section 4. This causes the following correction of the display state of the gauge-like image to be carried out. In this case, first, the operation section 4 outputs an image changing completion signal to the image data changing control section 11.

When the signal is inputted, the image data changing control section 11 outputs all the gauge-like image data, stored in the memory (not shown), to the parameter correction section 15. The parameter correction section 15 which has received the data selects one of data sets that have been inputted. Further, the parameter correction section 15 specifies an identifier, corresponding to a gauge-like image coded by the gauge-like image data, in accordance

with thus selected data.

Next, the parameter correction section 15 accesses the correction database 22, and specifies a parameter correction table, which should be used, in accordance with the specified identifier. Further, the parameter correction section 15 corrects the parameter, included in the gauge-like image data, with reference to the specified parameter correction table.

At this time, the parameter correction section 15 first confirms values of various parameters stored in the gauge-like image data. Next, the parameter correction section 15 judges whether or not each of the values is within an allowable range, determined in the parameter correction table, within which a value of each parameter can increase or decrease. The judgment enables the instrument panel image display device 1 to previously detect that a gauge-like image whose display state is inappropriate to the driver (for example, a display state which drops the visibility) is included in the instrument panel image.

Here, in case where the parameter correction section 15 judges that each of the values of the parameters included in the gauge-like image data is not within the allowable range, stored in the parameter correction table, within which a value of each parameter can increase or decrease, the parameter correction section 15 changes the parameter value into a value within the

allowable range, stored in the parameter correction table, within which a value of each parameter can increase or decrease.

Due to the change, in the instrument panel image display device 1, the parameter value is set so that the parameter does not limitlessly has any value but is limited within a predetermined range. Thus, in the instrument panel image display device 1, it is possible to appropriately display a gauge-like image so that the image whose display state is not inappropriate to the driver (so that the visibility is not dropped for example). For example, when the allowable range within which a value of the parameter can increase or decrease is previously set to a value range which allows the driver to clearly recognize the gauge-like image, it is possible to change the gauge-like image, which is hard to recognize, into a display state which allows the driver to clearly recognize the gauge-like image.

Here, the parameter correction section 15, for example, sets each of various parameters to an arbitrary value of an allowable range within which a value of each parameter stored in the correction data can increase or decrease. However, it is preferable that the parameter correction section 15 changes the value into a value, closest to a set value of the allowable range within which a value of the parameter can increase or decrease. For example, in case where a certain parameter is set to 100 and a value the

parameter should have is set to 50 to 70, it is preferable that the parameter correction section 15 sets the parameter to 70. Thus, it is possible to set the display state of the gauge-like image to be most similar to a display state adjusted by the driver.

Further, the parameter correction section 15, for example, also can change each of various parameters into a parameter value, stored in the parameter correction table, which optimizes the display state. In this case, as illustrated in Fig. 4, the correction data includes most appropriate recommendable values 1 to n which should be reached by a certain parameter.

The parameter correction section 15 carries out the foregoing correction of gauge-like image data with respect to all the inputted gauge-like image data. Further, when the correction is finished, the parameter correction section 15 outputs all the corrected data to the image data changing control section 11. When the gauge-like image data is inputted, the image data changing control section 11 temporarily stores the inputted data into a memory (not shown). Further, the image data changing control section 11 outputs the inputted data to the image display section 17.

When the data is inputted, the image display section 17 uses the gauge-like image data whose parameter has been corrected so as to update an instrument panel image displayed in the instrument panel 2. In this case, the image display section 17

causes the instrument panel 2 to display a message which requires the driver to confirm whether the current display state is appropriate or not. At this time, for example, the instrument panel 2 displays an “OK” button and a “Next recommendable value” button.

Here, in case where the driver presses the “Next recommendable value” button via the operation section 4, the operation section 4 outputs a next recommendable value selection signal to the image data changing control section 11. When the signal is inputted, the image data changing control section 11 outputs thus inputted next recommendable value selection signal and the gauge-like image data stored in the memory (not shown) to the parameter correction section 15. Thus, the parameter correction section 15 accesses the correction database 22, and obtains the next recommendable parameter value (second recommendable value). Further, the parameter correction section 15 changes a value of the parameter, included in the gauge-like image, into the next recommendable value.

The parameter correction section 15 carries out the correction with respect to all the inputted gauge-like image data. When the correction is finished, the parameter correction section 15 outputs all the corrected gauge-like image data to the image data changing control section 11. When the corrected gauge-like image data is

inputted, the image data changing control section 11 temporarily stores the inputted gauge-like image data into the memory (not shown) as described above. Further, the image data changing control section 11 outputs the inputted data to the image display section 17.

When the data is inputted, the image display section 17 uses the gauge-like image data whose parameter has been changed into the next recommendable value so as to update an instrument panel image displayed in the instrument panel 2. In this case, the image display section 17 causes the instrument panel 2 to display a message which requires the user to confirm whether the current display state is appropriate or not. At this time, as described above, the instrument panel 2 displays an “OK” button and a “Next recommendable value” button.

Here, when the driver presses the “Next recommendable value” button, the aforementioned process causes the parameter included in the gauge-like image data to be rewritten into a further next recommendable value (third recommendable value) included in the correction data. Note that, it is possible to repeat the process until the last recommendable value (n-th recommendable value) included in the correction data is used.

Meanwhile, when the driver presses the “OK” button via the operation section 4, the operation section 4 outputs an image

changing completion signal to the image data changing control section 11. When the image changing completion signal is inputted, the image data changing control section 11 outputs the signal to the image display section 17. Here, when the image changing completion signal is inputted, the image display section 17 causes the instrument panel 2 to display an instrument panel image at the time of a normal operation. While, the image data changing control section 11 outputs the gauge-like image data and a reserve data update signal to the reserve data obtaining section 12. When the data and the signal are inputted, the reserve data obtaining section 12 writes the inputted gauge-like image data into the reserve data storage section 6.

Due to the foregoing process, the instrument panel image displayed in the instrument panel 2 is updated into a new instrument panel image displayed with a new combination of gauge-like images which has been changed by the driver.

With reference to Figs. 5 to 10, the following description will explain a specific example of the aforementioned process in which the gauge-like image is changed.

Fig. 5 illustrates an example of various gauge-like images which can be disposed in the instrument panel image. In Fig. 5, the instrument panel image displayed in the instrument panel 2 is constituted by combining gauge-like images, such as a navigator, a

speed meter, and a shift indicator with a background image.

Here, when the driver selects the change of the speedometer image via the operation section 4, as illustrated in Fig. 6, thumbnail images 001 to 006, stored in the image database 21, each of which indicates a speedometer image, are displayed in the instrument panel 2. Note that, as illustrated in Fig. 6, the driver selects the thumbnail image 001.

Then, as illustrated in Fig. 7(a), the speedometer image selected by the driver, i.e., the speedometer image corresponding to the thumbnail image 001 is displayed at a position where the speedometer image is supposed to be disposed in the instrument panel image of Fig. 5. However, a color of the speedometer image selected by the driver is extremely close to a color of the background image, so that the speedometer image is not clearly displayed. Thus, such display state prevents the driver from recognizing the speed while driving the vehicle. This results in a higher possibility that an accident may occur.

Thus, in the instrument panel image display device 1, as described above, a function of the parameter correction section 15 causes the speedometer image displayed as illustrated in Fig. 7(a) to be corrected, so as to display the speedometer image as illustrated in Fig. 7(b). Fig. 7(b) illustrates an instrument panel image in which a speedometer image corrected by the parameter

correction section 15 is disposed. As illustrated in Fig. 7(b), the parameter correction section 15 uses the parameter correction table stored in the correction database 22 so as to correct the parameter which specifies the display state of the speedometer image. Speed graduations and a bar indicative of the vehicle speed are hard to recognize because they are blended in the background image before being corrected. However, in Fig. 7(b), the speed graduations and the bar can be clearly recognized. In this manner, the instrument panel image display device 1 corrects the gauge-like image data so that the speedometer is clearly recognized by the driver.

Further, the correction carried out by the parameter correction section 15 with respect to the gauge-like image data is effective also in correcting gauge-like image data adjusted by the parameter adjusting section 16. This is exemplified as follows with reference to Figs. 8 to 10.

Fig. 8 illustrates an example of areas which can be occupied by gauge-like images disposed in the instrument panel image. As to a navigator image and a speedometer image, Fig. 8 illustrates minimum display areas and maximum areas in which these images can be disposed. These areas can be calculated in accordance with the parameter correction table stored in the correction database 22 for example. That is, these areas can be calculated in accordance with values, included in the parameter correction table, each of

which indicates an allowable size range and an allowable position range thereof.

Here, it is assumed that the driver changes a size and a position of the navigator image and a size and a position of the speedometer image via the operation section 4 and the parameter adjusting section 16 as illustrated in Fig. 9(a). When the sizes and positions are changed, as illustrated by a broken line in Fig. 9(b), these adjusted gauge-like images extend over the maximum display areas.

Thus, the parameter correction section 15 corrects the parameter for defining each of the navigator image and the speedometer image so that the image is positioned within the maximum display area as illustrated in Fig. 19(c). On this account, it is possible to prevent the gauge-like images from overlapping each other or prevent sizes thereof from being excessively reduced, thereby preventing the gauge-like images from being hard for the driver to recognize.

Fig. 10 illustrates other example where the speedometer image is corrected. Fig. 10(a) illustrates a speedometer image that the driver selects via the operation section 4. A display state of the image is neither adjusted by the parameter adjusting section 15 nor corrected by the parameter correction section 15. That is, the image is displayed according to a parameter in an initial state (default).

When the driver adjusts a size of the image via the parameter adjusting section 16, an image illustrated in Fig. 10(b) is obtained. Note that, in the speedometer image, display states of speed graduations and other part (bar indicative of a current speed or a similar part) of the speedometer can be set separately from each other. The bar indicative of a current speed or a similar part which are illustrated in Fig. 10(b) changes its size so as to correspond to change of a size of an entire image, but a size of each speed graduation does not change. A position where each speed graduation is disposed in the speedometer image changes according to change in the size of the entire image.

Here, in the image illustrated in Fig. 10(b), when the driver makes the size of the speed graduation larger and disposes thus enlarged speed graduation in the instrument panel image via the operation section 4 and the parameter adjusting section 16, an image illustrated in Fig. 10(c) is obtained. As illustrated in Fig. 10(c), the size of the speed graduation which has been set by the driver via the parameter adjusting section 16 is not balanced with the size of the speed bar. Thus, for the driver, the speed graduation and the speed bar seem not to be balanced with each other. Further, the speed graduation overlaps the shift indicator image, so that these images are hard for the driver to recognize.

Thus, the parameter correction section 15 uses the correction

database 22 in which correction values calculated in consideration for the foregoing points are stored in the parameter correction table, thereby correcting the parameter for defining the display state of the speedometer image. Fig. 10(d) illustrates an image obtained by changing the image of Fig. 10(c) on the basis of the foregoing correction. As illustrated in Fig. 10(d), in the corrected speedometer image, the size of the speed graduation is adjusted so as to be balanced with the size of the speed bar, so that the images are easy for the driver to recognize. Further, the speed graduation and the shift indicator do not overlap each other, so that both the images are easy to recognize.

Note that, in the instrument panel image display device 1, it is preferable to correct the speedometer image or other gauge-like image in accordance with the display state of the speedometer image disposed in the instrument panel image. That is, in the present instrument panel image display device 1, the parameter correction section 15 corrects parameters for defining display states of various gauge-like images so that the display state of the speedometer image is corrected into a display state which can be clearly recognized by the driver.

For example, the speedometer is a gauge for indicating a speed of a vehicle to the driver, and is one of the most important gauges required in safety driving of the vehicle. Thus, it is most preferable

to dispose, in the instrument panel image, the speedometer image at a predetermined position within a range most appropriately determined in advance so as to be in front of the driver or so as to be covered by a visual field of the driver. This enables the driver to confirm the speed of the vehicle with minimum movement of his/her visual line.

Thus, it is preferable that the correction database 22 stores a value for defining a region in which the corrected speedometer image is disposed in the instrument panel image so as to be positioned substantially in front of the driver. In case where this arrangement is adopted, even when the driver disposes the speedometer image in an end side of the instrument panel image, the parameter correction section 15 makes correction so that the speedometer image is positioned near to the front of the driver. Thus, it is possible to prevent the speedometer image from being disposed so that its display state is hard for the driver to recognize.

Note that, the instrument panel image display device of the present invention may be arranged so that: as illustrated in Fig. 11, gauge-like image data which codes a replacing gauge-like image is obtained from a server, which has a storage section storing the gauge-like image data, via a network line. In this case, the instrument panel image display device and the server constitute an instrument panel image changing system. Note that, as to the

background image data, the same arrangement is adopted.

The following description explains an instrument panel image changing system 40 illustrated in Fig. 11. Fig. 11 is a block diagram illustrating a detail arrangement of the instrument panel image changing system 40 which includes: a server 80 having a storage section storing the gauge-like image data; and an instrument panel image display device 50 for obtaining the replacing gauge-like image data from the server 80. As illustrated in Fig. 11, the present instrument panel image changing system 40 includes the instrument panel image display device 50 and the server 80.

Here, as illustrated in Fig. 11, the instrument panel image display device 50 includes an instrument panel 52, an operation section 54, a reserve data storage section 56, and an image data changing section (image data changing means) 60. Out of them, the instrument panel 52, the operation section 54, and the reserve data storage section 56 are respectively arranged in the same manner as in the instrument panel 2, the operation section 4, and the reserve data storage section 6, so that description thereof will be omitted.

Note that, the instrument panel image display device 50 is characterized by the image data changing section 60. Thus, the image data changing section 60 is detailed as follows with reference to Fig. 11.

As illustrated in Fig. 11, the image data changing section 60 includes an image data changing control section (image data changing control means) 61, a reserve data obtaining section 62, a parameter adjusting section (parameter adjusting means) 63, a parameter correction section (parameter changing means, parameter judging means) 64, a communication section (image data obtaining means) 65, and an image display section (display means) 66. Out of them, the reserve data obtaining section 62, the parameter adjusting section 63, the parameter correction section 64, the image display section 66, and the correction database 70 are respectively arranged in the same manner as in the reserve data obtaining section 12, the parameter adjusting section 16, the parameter correction section 15, and the correction database 22, so that description thereof will be omitted.

The communication section 65 sends a thumbnail image data request signal and a gauge-like image data request signal to a server communication section 82 provided on the server 80. These signals will be described later. Further, the communication section 65 has a function for receiving the thumbnail image data and the gauge-like image data that have been sent from the server communication section 82. That is, in the present instrument panel image display device 50, the communication section 65 has a function for obtaining the thumbnail image data and the gauge-like

image data from the server 80 via a network line.

The image data changing control section 61 has not only a function for controlling entire operations of the image data changing section 60 but also a function for generating the thumbnail image data request signal and the gauge-like image data request signal that are sent from the communication section 82. This will be detailed later.

The server 80, as illustrated in Fig. 11, has a server control section 81, a server communication section 82, a thumbnail image data obtaining section 83, a gauge-like image data obtaining section 84, and an image database 90.

The server control section 81 controls entire operations of the server 80.

The server communication section 82 receives the thumbnail image data request signal and the gauge-like image data request signal that are sent from the communication section 65. Further, the server communication section 82 has also a function for sending the thumbnail image data and the gauge-like image data to the communication section 65.

The image database 90 is a database storing the gauge-like image data which codes various gauge-like images such as the aforementioned speedometer image with them related to identifiers and corresponding thumbnail images. In this view point, the image

database 90 is the same as the image database 21. However, unlike the image database 21, the image database 90 stores gauge-like image data corresponding not only to a specific instrument panel image display device but also various kinds of vehicles and various kinds of instrument panel image display devices.

That is, the image database 90 stores the gauge-like image data and the thumbnail image data with them related not only to identifiers for respectively defining the data but also to a vehicle identifier indicative of a kind of an applicable vehicle and a device identifier indicative of a kind of the instrument panel image display device 50. Thus, the server 80 including the image database 90 can provide the gauge-like image data, requested from various kinds of instrument panel image display devices 50 installed on various kinds of vehicles, according to each vehicle or each device which has requested the gauge-like image data.

The following description will detail the instrument panel image changing system 40.

In this system, the instrument panel image display device 50 operates in the same manner as in the aforementioned instrument panel image display device 1 in terms of operations performed until the instrument panel 2 displays an image which allows the driver to input selection of a category of a replacing gauge-like image. When the image is displayed, the driver selects a category (for example,

speedometer, tachometer, or the like) to which the replacing gauge-like image belongs. Thus, the operation section 4 outputs a category identification signal, indicative of a category to which the replacing gauge-like image belongs, to the image data changing control section 61.

When the category identification signal is inputted, the image data changing control section 61 generates a thumbnail image data request signal obtained by adding to this signal (i) a device identification signal indicative of a kind of the instrument panel image display device 50 and (ii) a vehicle identification signal indicative of a kind of a vehicle having the instrument panel image display device 50. Further, the image data changing control section 61 outputs the thumbnail image data request signal to the communication section 65.

The communication section 65 which has received the thumbnail image data request signal sends this signal to the server communication section 82. The server communication section 82 outputs thus received thumbnail image data request signal to the server control section 81.

When the thumbnail image data request signal is inputted, the server control section 81 analyses this signal, and specifies (i) a category to which the target gauge-like image data belongs, (ii) a kind of the instrument panel image display device used on the side

of the vehicle, and (iii) a kind of the vehicle having the instrument panel image display device. Further, in accordance with a result of the specifying operation, the server control section 81 generates a category identifier indicative of the category, a vehicle identifier indicative of a kind of the vehicle, and a device identifier indicative of a kind of the device. Thereafter, the server control section 81 generates identifier signals indicative of the identifiers, and outputs thus generated identifier signals to the gauge-like image data obtaining section 84.

When the identifier signals are inputted, the gauge-like image data obtaining section 84 accesses the image database 90, and obtains thumbnail image data corresponding to the identifier indicated by each identifier signal. For example, the image database 90, first, determines a sub-database to access (various kinds of gauge-like image databases such as a speedometer database: this is the same as in the background database) in accordance with a category identifier. Next, the image database 90 accesses thus determined sub-database, and obtains all the thumbnail image data, stored in the sub-database with them related to the device identifier and the vehicle identifier, in accordance with the device identifier and the vehicle identifier. Further, the gauge-like image data obtaining section 84 outputs thus obtained thumbnail image data to the server control section 81.

When the thumbnail image data is inputted, the server control section 81 outputs thus inputted data to the server communication section 82. The server communication section 82 sends thus inputted thumbnail image data to the communication section 65.

When the thumbnail image data is received, the communication section 65 outputs thus received data to the image data changing control section 61. The image data changing control section 61 outputs thus inputted data to the image display section 66. Thus, the image display section 66 causes the instrument panel 52 to display a thumbnail image coded by the thumbnail image data. Thereafter, the driver can select a selectable gauge-like image as a thumbnail image in the instrument panel 2 via the operation section 54.

Here, the driver selects one of thumbnail images displayed in the instrument panel 2 via the operation section 54. Then, the operation section 54 outputs an image identification signal, indicative of a replacing gauge-like image, to the image data changing control section 61.

When the image identification signal is inputted, the image data changing control section 61 generates a gauge-like image data request signal including the image identification signal, and outputs thus generated signal to the communication section 65. The communication section 65 sends the gauge-like image data

request signal to the server communication section 82.

When the server communication section 82 receives the gauge-like image data request signal, the server communication section 82 outputs thus received signal to the server control section 81. Then, the server control section 81 analyses the signal, and generates an identifier signal, indicative of an identifier corresponding to gauge-like image data to be obtained, in accordance with the image identification signal included in the gauge-like image data request signal. Further, the server control section 81 outputs the image identifier signal to the gauge-like image data obtaining section 84.

When the identifier signal is inputted, the gauge-like image data obtaining section 84 accesses the image database 90, and obtains single gauge-like image data, related to an identifier indicated by thus inputted identifier signal, in accordance with the identifier. Further, the gauge-like image data obtaining section 84 outputs thus obtained gauge-like image data to the server control section 81.

When the gauge-like image data is inputted, the server control section 81 outputs the inputted data to the server communication section 82. Then, the server communication section 82 sends the inputted gauge-like image data to the communication section 65.

When the communication section 65 receives the gauge-like

image data, the communication section 65 outputs the inputted data to the image data changing control section 61. Then, the image data changing control section 61 writes the inputted data into a memory (not shown), and outputs the data to the image display section 66.

Thus, the image display section 66 uses the inputted gauge-like image data so as to update the gauge-like image displayed in the instrument panel 52. Specifically, the image display section 66 replaces the gauge-like image, which has been displayed, with a gauge-like image, which is coded by the inputted gauge-like image data, thereby displaying the replacing gauge-like image. Thus, a new gauge-like image selected by the driver is displayed in the instrument panel 52 instead of an old gauge-like image.

The aforementioned instrument panel image changing system 40 is only an example, and the system can be arranged in other manner. For example, it can be arranged so that the correction database 70 is incorporated into the server 80.

In this case, a correction data obtaining section (not shown) for obtaining the correction data from the correction database 70 in the server 80 is provided on the server 80. Further, in the server 80, the correction data obtaining section obtains the correction data from the correction database 70 according to the correction data

request signal sent from the communication section 65. Further, the server 80 sends the data to the instrument panel image display device 50 via the server communication section 82. Thus, the instrument panel image display device 50 uses the parameter correction data obtained from the server 80, so that the parameter correction section 64 corrects the parameter included in the gauge-like image data.

Alternatively, it can be so arranged that also the parameter correction section 64 is incorporated into the server 80. In this case, a parameter value for defining a display state of a gauge-like image and an identifier signal for specifying a kind of the gauge-like image whose display state is defined by the parameter are sent to the server 80. Further, on the side of the server 80, an identifier indicated by the identifier signal is used to obtain the parameter correction data from the correction database 70, and thus received parameter value is corrected. Further, thus changed parameter value is sent to the instrument panel image display device 50.

In this case, in the instrument panel image display device 50, for example, the parameter adjusting section 63 uses the received parameter value so as to change the parameter value to be corrected. Also such arrangement enables the parameter for defining the display state of the gauge-like image to be corrected.

Further, it can be so arranged that the system sends

uncorrected gauge-like image data to the server 80 instead of sending the parameter value. According to this system, the parameter is corrected in the server. Further, the server communication section 82 sends the gauge-like image data, whose parameter has been corrected, to the instrument panel image display device 50. In the instrument panel image display device 50, an image based on the corrected gauge-like image data received is displayed without any modification.

In this manner, in the instrument panel image changing system 40, the instrument panel image display device 50 obtains the gauge-like image data from the server 80. Thus, even in case where gauge-like image data which codes a new selectable gauge-like image is provided, it is possible to easily obtain the data. That is, even when data is updated on the side of the server or new data is added, it is possible to use the new data immediately.

Next, with reference to Figs. 12 to 18, the following description will detail how the instrument panel image display device 1 (Fig. 1) changes the background image (background image changing mode). Note that, operations in the background image changing mode are basically the same as those in the aforementioned gauge-like image changing mode, so that only differences therebetween will be explained.

Fig. 12 is a flowchart schematically illustrating operations in

the background image changing mode.

In the background image changing mode, first, the image data changing control section 11 judges whether or not to change the background image (S11). Further, in case of changing the background image (YES in S11), the parameter correction section 15 corrects a parameter of new background image data which the gauge-like image data obtaining section 14 has obtained by accessing the image database 21 (S12). Note that, correction carried out by the parameter correction section 15 with respect to the parameter of the background image data will be detailed later.

Thereafter, the image display section 17 deletes an old background image displayed in the instrument panel 2 (S13), and the new background image based on the background image data whose parameter has been corrected in S12 and the gauge-like image are synthesized with each other (S14), and the instrument panel image is displayed in the instrument panel 2 (S15).

Here, in case of displaying, as a background of the instrument panel image, an image which has been made not as the background of the instrument panel image (e.g., a photograph image taken by a user or a similar image), the number of colors, a hue, a brightness difference, and the like of the image are not taken into consideration, so that the visibility may drop when the image is synthesized with the gauge-like images.

Thus, in the instrument panel image display device 1, the number of colors, a hue, a brightness difference, and the like of the background image are automatically changed when changing at least the gauge-like image or the background image, and thus changed background image is synthesized with the gauge-like image, thereby securing the visibility. Thus, it is possible to display, as the background image of the instrument panel image, an image desired by the user (for example, a photograph image) without dropping the visibility of the gauges.

Note that, the process for changing the background image may be started at the following timings: (i) When the user inputs an instruction to change the background image via the operation section 4; (ii) When the background image data is stored in a predetermined memory region. Note that, the predetermined memory region may be set in the image database 21 in advance. Further, in order to store the background image data into the predetermined memory region, it may be so arranged that the user causes the data to be read from a storage medium, or it may be so arranged that an external terminal or the like carries out the storage via a network; (iii) Ordinarily, when it is detected that the background image data stored in the reserve data storage section 6 is changed as an initial image displayed at the time of operation commencement. In case where the change of the background image

data is detected at the time of startup, the background image is changed at the time of a next startup after the background image data is changed.

Further, it may be so arranged that: at the time of startup of the instrument panel image display device 1, first, a photograph image which is to serve as the background image is displayed in an entire screen, and then the gauge-like images of respective parts are disposed as foregrounds.

The following description will detail how the parameter correction section 15 corrects the parameter of the background image (S12 of Fig. 12).

In case where a general photograph is used as the background image of the instrument panel image, there is no tendency in its color distribution, so that it is difficult to secure the visibility, as compared with an image originally made as the background image of the instrument panel image, even when the color and the size are changed. Therefore, in the instrument panel image display device 1, in case of using a general photograph as the background image of the instrument panel image, the following corrections of the parameter of the background image data are carried out in order to improve the visibility. Note that, the following corrections may be separately carried out, or may be carried out in combination.

(1) To monotonize the background image with a standard color

determined in accordance with its color distribution

The image data changing section 10 changes the background image into a monotone image. Specifically, the image data changing section 10 calculates the color distribution of the background image, and determines a mainly used color as a standard color, and uses a doubletone (for example, approximately 16 grayscales) based on the standard color so as to change the background image into a monotone image.

Here, in case where the color mainly used in the background image has a bad influence on the visibility of the gauges, a secondarily most used color is used as a second recommendable standard color so as to change the background image into a monotone image. Further, in case where also the second recommendable standard color has a bad influence on the visibility of the gauges, a thirdly most used color may be used as a third recommendable standard color. That is, colors more used in the background image are more preferentially judged whether or not each of the colors is appropriate as the standard color. Note that, in case where all the recommendable colors are inappropriate as the standard color, a predetermined effective color (for example, white, black) may be used as the standard color. Further, how much the color is used in a single image can be judged in accordance with the number of pixels corresponding to each color

for example.

In this manner, by using a color mainly used in the background image, it is possible to monotonize the background image without deteriorating the impression obtained by coloring the instrument panel. Further, by monotonizing the background image in this manner, it is possible to avoid diffusive coloring of the background image. Thus, it is possible to most clearly distinguish the coloring of the gauge-like images, thereby improving the visibility. Note that, as long as the coloring of the background image is not diffusive, other colors may be mixed without strictly fixing the image to a monotone image.

Here, Fig. 13 illustrates how to determine the standard color. In Fig. 13, a color mainly used in the background is “blue (RGB 63 : 136 : 189)”, and a color secondarily most used is “green (RGB 24 : 123 : 42)”. Further, in the foregrounds (corresponding to the gauge-like images), “brown (RGB 127 : 90 : 23)” and “green (RGB 158 : 212 : 74)” are used. Thus, in case of this example, “blue (RGB 63 : 136 : 189)” is adopted as the standard color for monotonizing the background image, and “green (RGB 24 : 123 : 42)” is changed into a color in its doubletone.

Fig. 14 is a flowchart for schematically illustrating a process for changing the background image into a monotone image by using a doubletone based on a color mainly used in the background

image.

First, the gauge-like image data obtaining section 14 extracts the background image data from the image database 21 (S21). Next, the image data changing control section 11 calculates color distribution of the background (S22), and determines the mainly used color as a first recommendable color, a secondarily most used color as a second recommendable color, and a thirdly most used color as a third recommendable color (S23 to S26).

Next, the image data changing control section 11 calculates color distribution of the gauge-like image (S27). Further, whether the first recommendable color is included in the color distribution of the gauge-like image or not is judged (S28, S29). When the first recommendable color is not included (YES in S29), the parameter correction section 15 monotonizes the background image by using the recommendable color (S31). Further, when the recommendable color is included in the color distribution of the gauge-like image (NO in S29), the next recommendable color is used so as to repeat the judgment (S30).

Likewise, it may be so arranged that: the image data changing section 10 calculates color distribution of a currently displayed gauge-like image in changing the background image into a monotone image, and uses a color which is not used in the gauge-like image or a color less used in the gauge-like image as the

standard color, and uses a doubletone (for example, approximately 16 grayscales) based on the standard color, so as to change the background image into a monotone image.

In this manner, by monotonizing the background image with a color which is not used in the gauge-like image, it is possible to avoid the diffusive coloring of the background image. Thus, it is possible to most clearly distinguish the coloring of the gauge-like image, thereby improving the visibility.

(2) To monotonize the background image with a standard color determined on the basis of color distribution of the background image and a letter color of the gauge-like image

The image data changing section 10 calculates the color distribution of the background image in changing the background image into a monotone image, and determines the more used colors as the standard color more preferentially. In case where a combination of each of the standard color and the letter color of the gauge-like image is not forbidden in advance, the image data changing section 10 uses a doubletone (for example, approximately 16 grayscales) based on the standard color, so as to change the background image into a monotone image. Note that, in case where all the recommendable standard colors are inappropriate, an effective color (for example, white, black) determined in advance may be used as the standard color. Further, how much the color is

used can be determined in accordance with the number of pixels for example.

In this manner, by using a color mainly used in the background image, it is possible to monotonize the background image without deteriorating the impression obtained by coloring the instrument panel. Further, by monotonizing the background image in this manner, it is possible to avoid diffusive coloring of the background image. Further, an inappropriate combination of the standard color and the letter color of the gauge-like image is forbidden in advance, thereby determining the standard color so that recognition of important letter information in the instrument panel image is not prevented. Thus, it is possible to most clearly distinguish the coloring of the gauge-like image, thereby improving the visibility. Note that, as long as the coloring of the background image is not diffusive, other colors may be mixed without strictly fixing the image to a monotone image.

Fig. 15 is a flowchart for schematically illustrating a process for changing the background image into a monotone image by using a doubletone based on a color out of colors mainly used in the background image in case where the combination of the color and a letter color of the gauge-like image is not forbidden in advance.

First, the gauge-like image data obtaining section 14 extracts the background image data from the image database 21 (S41). Next,

the image data changing control section 11 calculates color distribution of the background image (S42), and determines the mainly used color as a first recommendable color, a secondarily most used color as a second recommendable color, and a thirdly most used color as a third recommendable color (S43 to S46).

Next, the image data changing control section 11 extracts a letter color of the gauge-like image (S47). Further, whether a combination of the letter color of the gauge-like image and the first recommendable color is a forbidden combination or not is judged (S49). Specifically, whether or not a code of a recommendable color which cannot be used as the background image color is included in a combination forbidding table predefined for each letter color of the gauge-like image is judged. Note that, the combination forbidding table may be stored in the correction database 22. Further, when the combination of the letter color of the gauge-like image and the first recommendable color is not forbidden (YES in S49), the parameter correction section 15 uses the recommendable color so as to monotonize the background image (S51). Further, when the combination of the letter color of the gauge-like image and the first recommendable color is forbidden (NO in S49), the next recommendable color is used so as to repeat the judgment (S50).

(3) To correct luminance of the background image

In case of using a general photograph as the background

image of the instrument panel image, the image varies in terms of its brightness, contrast, and the like, depending on tendency or the like of lighting in a spot where the photograph has been taken. Thus, the image data changing section 10 corrects the background image data so as to drop the luminance of the background image so that average luminance of the background image is lower than average luminance of the gauge-like image by not less than a predetermined value. Thus, the gauge-like image is made brighter than the background image by not less than predetermined luminance, thereby improving the visibility.

Fig. 16 is a flowchart for schematically illustrating a process for correcting luminance of the background image.

First, the gauge-like image data obtaining section 14 extracts the background image data from the image database 21 (S61). Next, the image data changing control section 11 calculates color distribution of the gauge-like image and the background image (S62), and calculates average luminance thereof (S63).

Next, the image data changing control section 11 judges whether or not average luminance of the background image is lower than average luminance of the gauge-like image by not less than a predetermined value (S64). Further, when a difference between the average luminance of the background image and the average luminance of the gauge-like image is smaller than the

predetermined value (NO in S64), the image data changing control section 11 calculates a luminance correction value of the background image so that the average luminance of the background image is lower than the average luminance of the gauge-like image by not less than the predetermined value (S65), and the parameter correction section 15 uses the luminance correction value so as to correct the luminance of the background image (S66).

Here, the luminance correction value may be constant regardless of the luminance value to be corrected, or may be set according to largeness of the luminance value. That is, the luminance correction value may be dropped at a constant value regardless of the grayscale, or may be greatly dropped in case of low grayscale and may be slightly dropped in case of high grayscale.

Further, the luminance may be dropped by evenly dropping RGB signals, or may be dropped by making the backlight dark. Note that, in case of the latter, when the instrument panel 2 is provided with an LED backlight (white or RGB), the backlight may be made dark by controlling the backlight for every several dots.

Note that, the luminance is corrected in the foregoing description, but the contrast (chromaticity, brightness, chromaticness) may be corrected.

(4) To border the gauge-like image

The image data changing section 10 marks a periphery of each

gauge with a predetermined color so that the gauge is bordered. This improves the visibility of the gauge-like image. Thus, even in case of dropping the luminance of the background image, the border of the gauge-like image enables the luminance correction value (correction amount) of the background image to be small. As a result, it is possible to use a background image more similar to the original image. Of course, it is possible to further improve the visibility when the gauge-like image is bordered after the luminance correction.

Fig. 17 is a flowchart for schematically illustrating a process for bordering the gauge-like image.

First, the gauge-like image data obtaining section 14 extracts the background image data from the image database 21 (S71). Next, the parameter correction section 15 extracts a peripheral portion of the background image (S72).

Next, the parameter correction section 15 extracts a color of a letter included in the gauge-like image (gauge letter color) (S73). Further, the parameter correction section 15 refers to a predetermined color table in accordance with the gauge letter color (S74), so as to determine a bordering color (S75). Note that, the color table is stored in the correction database 22 in advance.

Lastly, with the bordering color, the parameter correction section 15 marks the background image's portion surrounding a

peripheral portion of the gauge-like image (S76).

Here, the color table is a table which indicates RGB values of a color for bordering (bordering color) with them corresponding to RGB values of a letter color used in the gauge-like image (gauge letter color). Note that, in the color table, the number of gauge letter colors is predetermined. Thus, in case where a color different from the gauge letter color indicated by the table is used as a color of the gauge letter, there are used RGB values of a bordering color corresponding to gauge letter color RGB values which are closest to the color RGB values used.

Fig. 18 is an example of the color table indicative of a relationship between the gauge letter color and the bordering color. In an example illustrated in Fig. 18, RGB values of 8 colors (doubletone) and 254 colors (color) are defined as the gauge letter color, and the RGB values of the gauge letter color correspond to the RGB values of the bordering color.

According to the color table of Fig. 18, in case where the RGB values of the gauge letter color are 219, 219, 219 (light gray), a color indicated by 0, 0, 0 (black) is selected as the bordering color. Further, in case where the RGB values of the gauge letter color are 85, 85, 85 (dark gray), a color indicated by 255, 255, 255 (white) is selected as the bordering color. Further, in case where the RGB values of the gauge letter color are 219, 255, 255 (light blue), a

color indicated by 0, 0, 255 (dark blue) is selected as the bordering color. Further, in case where this table does not have the RGB values of the gauge letter color, for example, in case where the RGB values are 218, 254, 254, a color indicated by 219, 225, 255 is selected as approximated RGB values, so that the bordering color is 0, 0, 255.

Note that, the process for marking the periphery of each gauge with a predetermined color may be carried out with respect to the background image data as illustrated in the foregoing flowchart, or may be carried out with respect to the gauge-like image data.

Further, the bordering color may be predetermined in the gauge-like image data as an outline color, or may be calculated in accordance with the gauge letter color and the background image color.

(5) To inherit the parameter of the background image

In case of changing the background image, an unchanged original background image A is in a state (color distribution, brightness, contrast, and the like) suitable for display of the gauge-like image selected at this time, but a changed background image B is not always in the same state as in the original background image A. Thus, the image data changing section 10 carries out the image correction by changing a parameter of the new background image B so that a value indicative of the state of

the new background image B is a value approximate to a value indicative of the state of the original background image A.

The image data changing section 10 enables the new background image B to be in the same state as in the original background image A by carrying out the following corrections with respect to the new background image B for example. (i) Color distribution of the original background image A is calculated, and a color of the new background image B is changed so as to have an approximate value of a color used in the color diffusion, thereby correcting the image. (ii) The brightness and the contrast of the original background image A are calculated, and the brightness and the contrast of the new background image B are changed so as to have approximate values of the brightness and the contrast of the original background image A, thereby correcting the image. (iii) There is provided a table, storing the predetermined values of the brightness and the contrast of the original background image A, in accordance with which values of the new background image B are corrected into the predetermined values.

Here, each of the instrument panel image display device 1 and the instrument panel image changing system 40 is nothing but one embodiment for carrying out the present invention. That is, as will be described later, the present invention can be varied within the scope of claims.

For example, any data format can be used as a data format of the aforementioned gauge-like image data as long as the data format codes the image. That is, as the data format of the gauge-like image data and the background image data, it is possible to adopt: a format in which an image such as BMP (Bitmap) or the like is stored at bit unit; a compressed data format such as TIFF (Tagged Image File Format) and JPEG (Joint Progressive Experts Group); or a vector data format such as EPS (Encapsulated PostScript) and PDF (Portable Document Format).

Note that, in case of adopting the Bitmap as the data format of the gauge-like image data and the background image data, plural sets of Bitmap data indicating gauge-like images and a background image each of which varies in its size are prepared, and each of these images is changed so as to have a size set by the driver, thereby changing the display state without deteriorating a resolution of the image. Meanwhile, by changing single Bitmap data, it is possible to display gauge-like images and a background image each of which varies in its size.

Further, each of the gauge-like image data and the background image data may be data which codes a single still image, or may be data which codes a moving image constituted of plural still images. Further, each of the gauge-like image data and the background image data may be a data group constituted of

plural sets of gauge-like image data and plural sets of background image data each of which codes a single still image. For example, in the speedometer, with variation of the running speed of the vehicle, a state of the image displayed in the instrument panel is varied as time elapses. Thus, the gauge-like image data which codes the speedometer image is an image data group constituted of plural sets of image data each of which codes a still image indicating a state of the running speed.

Note that, any format can be adopted as long as each of the image database 21 and image database 90 can store the gauge-like image data, the background image data, the thumbnail image data. Further, any format can be adopted as long as each of the correction database 22 and the correction database 70 can store the correction parameter value and the identifier for specifying a kind of a parameter of the correction target with them related to each other. That is, as these databases, it is possible to adopt a hash-format database or a relational database in which the identifier and the data are stored with them related to each other.

Further, each of the correction database 22 and the correction database 70 stores a parameter correction table corresponding to each of categories to which various gauge-like image data and background image data respectively belong. On this account, it is possible to reduce the size of the database. However, the database

may store a parameter correction table, indicative of each data, which corresponds to each of various gauge-like image data and each of various background image data. In this case, it is possible to finely adjust a display state of at least either the gauge-like image or the background image as compared with a format in which the parameter correction table corresponding to each category is stored.

Further, each of these databases is stored in an arbitrary nonvolatile storage medium (memory). Further, as to the storage medium, it does not matter whether it is possible to rewrite (write) data therein or not, and it does not matter how the storage is carried out, and it does not matter what shape the storage medium has. Examples of the storage medium include tapes, such as magnetic tape and cassette tape; disks including magnetic disks, such as floppy disks (registered trademark) and hard disk, and optical disks, such as CD-ROMs, magnetic optical disks (MOs), mini disks (MDs), and digital video disks (DVDs); cards, such as IC card and optical cards; and semiconductor memories, such as mask ROMs, EPROMs, EEPROMs, and flash ROMs.

Further, in each of the correction database 22 and the correction database 70, a kind of the sub-table stored in the parameter correction table is not limited to the table illustrated in Fig. 4. That is, a sub-table for correcting other parameter may be

included in the parameter correction table of each of the correction database 22 and the correction database 70. For example, the parameter correction table may include a sub-table which stores a correction value concerning luminance of each gauge-like image, a distance allowed between a gauge-like image and other gauge-like image, or a distance allowed between letters included in the gauge-like image.

Further, when changing a recommendable value of the parameter to a next recommendable value, each of the parameter correction section 15 and the parameter correction section 64 may change, for example, a value of only the parameter designated by the driver to a next recommendable value instead of uniformly changing values of all parameters corresponding to all gauge-like images into next recommendable values. Further, each of the parameter correction section 15 and the parameter correction section 64 may automatically correct the parameter, immediately after changing the parameter, without waiting for a correction instruction given by the driver via the operation section 4.

Further, in the instrument panel image display device 1, the instrument panel 2 (display panel) is a display panel for displaying an image based on image data. The instrument panel 2 is a panel, long from side to side, whose aspect ratio indicative of a horizontal-vertical size ratio of its display area is not less than 7 :

3. Thus, it is possible to improve the visibility in case where an additional image such as a navigation image and a vehicle state image indicative of a vehicle state such as a speed and fuel of the vehicle are simultaneously displayed. Further, the aspect ratio may be set to, more specifically, 8 : 3, 30 : 9, 32 : 9, or a similar ratio. Thus, the instrument panel 2 can be produced by combining two panels each of which has an aspect ratio of 4 : 3, 15 : 9, or 16 : 9. The instrument panel 2 of the present embodiment is a wide-size liquid crystal panel, but the instrument panel 2 is not limited to this. For example, an organic or inorganic EL (Electroluminescence) panel, a plasma display panel, a CRT (Cathode Ray Tube) may be used as the instrument panel 2. This is adoptable also to the instrument panel 52.

Further, the image display section 17 may display a single instrument panel image including a plurality of gauge-like images in accordance with plural sets of image data coding the gauge-like images. Further, the image data changing section 10 may change at least one of the plural sets of image data coding gauge-like images into image data coding other gauge-like image.

As to the input operation performed via the operation section 4 and the operation section 54, it is possible to adopt a touch panel, hard keys, a mouse, or a joy stick for example. Here, in case of realizing the operation section 4 and the operation section 54 by

using the touch panel, it is possible to respectively integrate the operation section4 and the operation section 54 to the instrument panel 2 and the instrument panel 52.

Further, as to the correction performed by the driver with respect to the display state of the gauge-like image, it is possible to adopt not only a method in which a value is directly inputted as a parameter value but also a method in which the parameter value is changed into a value corresponding to a display state of an image after directly changing the display state in the screen. For example, in case of changing the size of the image, it is possible to adopt a method in which a horizontal-direction size (X) and a vertical-direction size (Y) of the image are respectively inputted, or a method in which an input operation is carried out by operating a slide bar, or a method in which a size of the image is changed in the screen by carrying out a drag-and-drop operation. Further, it may be so arranged that: an “enlarge” button and a “reduce” button are displayed in the image, and these buttons are pressed by the driver via the operation section 4, so as to change the size of the gauge-like image.

Further, it may be so arranged that: a parameter for defining a display state of at least either the gauge-like image or the background image is stored not in the gauge-like image data and the background image data but collectively in other file. Further, it

is preferable that the parameter defines at least sizes and colors of the gauge-like image and the background image. Thus, it is possible to change at least sizes and colors of the gauge-like image and the background image.

Further, according to the present invention, when changing at least either the gauge-like image or the background image, it is possible to use a template file, corresponding to each category of at least either the gauge-like image or the background image, in which a parameter for defining the display state has been set in advance. In this case, a display state of at least either the gauge-like image or the background image which has been selected by the driver is changed immediately after the selection performed in accordance with the parameter value stored in the template file, so that it is possible to promptly finish the selection of at least either the gauge-like image or the background image.

Further, the foregoing description explained the case where the instrument panel image display device 1 is installed on the vehicle. Examples of the vehicle in the present specification include not only an automobile but also all land vehicles such as a motorbike, a bicycle, and the like each of which requires the driver to drive so as to move. Further, the instrument panel image display device 1 is not limited to a device installed on the vehicle, but can be adopted to various transportation apparatuses such as a

helicopter, a plane, a ship, and the like each of which requires the driver to drive so as to move. Further, the instrument panel image display device 1 is not limited to a device installed on the transport apparatus, but can be adopted to a general apparatus provided with a control panel.

Further, any method can be adopted as a communication method between the communication section 65 and the server communication section 82 as long as the communication is carried out on the basis of wireless transmission. Examples of the wireless transmission includes an infrared-ray communication used in IrDA and a remote controller; a communication which is in compliance with Bluetooth standard or IEEE802.11 standard; and a communication using HDR, a mobile phone network, or a ground wave digital network and the like. Further, in these communications, transmission and reception may be carried out with data and signals compressed.

Note that, each of the aforementioned members is a function block. Thus, these members are realized as follows: Computing means such as a CPU implements an instrument panel image display program stored in a storage section (not shown), and controls peripheral circuits such as an input/output circuit (not shown) and the like, thereby realizing the foregoing members.

Thus, the object of the present invention can be achieved as

follows: a storage medium for computer-readably storing an instrument panel image display program code (an execute form program, intermediate code program, or source program) of software for implementing the aforementioned functions is provided to the instrument panel image display device, and a computer (or CPU, MPU, and DSP) provided on the instrument panel image display device reads out the program code stored in the storage medium so as to implement the program, thereby achieving the object of the present invention.

In this case, the program code itself that has been read out from the storage medium realizes the aforementioned functions, and the storage medium storing the program code constitutes the present invention. Specifically, the image data changing section 10 provided on the instrument panel image display device 1 and the image data changing section 60 provided on the instrument panel image display device 50 are realized as follows: A predetermined program stored in a memory (not shown) of the instrument panel image display device is implemented by computing means such as a microprocessor, thereby realizing the image data changing section 10 and the image data changing section 60.

Meanwhile, each of the aforementioned members may be realized as a hardware for carrying out the same process as in the software. In this case, the object of the present invention is

achieved by an instrument panel image display device of hardware.

Here, the computing means for reading and implementing the program code functions by itself. Further, it may be so arranged that a plurality of computing means connected to each other via a bus provided in the instrument panel image display device and various communication paths implement the program code together.

Here, the program code which can be directly implemented by the computing means is distributed to the instrument panel image display device via a computer-readable storage medium storing the program code. Further, it may be so arranged that: the program code is distributed to the instrument panel image display device as data, which can generate a program code by carrying out a process such as uncompressing, via the computer-readable storage medium storing the data. Alternatively, it may be so arranged that: the program code or the data is distributed or transmitted to the instrument panel image display device via a wired or wireless communication path. Even when the program code is distributed or transmitted by any means, the program code is implemented by the computing means provided on the instrument panel image display device.

At this time, it is possible to transmit the program code or the data via various kinds of communication networks without being limited to a specific means. Specific examples of the communication

network include Internet, intranet, LAN, ISDN, VAN, a CATV communication network, a virtual private network, a telephone line network, a mobile communication network, a satellite communication network, and the like. Further, a transmission medium (communication path) constituting the communication network is not particularly limited. Specifically, it is possible to use a wired line such as a line in compliance with IEEE1394 standard, a USB line, a power line, a cable TV line, a telephone line, an ADSL line, and the like, as the transmission medium. Further, it is possible to use (i) a wireless line utilizing an infrared ray used in IrDA and a remote controller, (ii) a wireless line which is in compliance with Bluetooth standard or IEEE802.11 wireless standard, and (iii) a wireless line utilizing HDR, a mobile phone network, a satellite line, a ground wave digital network, and the like, as the transmission medium.

Note that, it is preferable that the storage medium for distributing the program code to the instrument panel image display device is detachable before distributing the program code. However, the storage medium may be detachable after distributing the program code, and the storage medium may be integrated to the instrument panel image display device so that the storage medium cannot be detached.

Further, as long as the storage medium stores the program

code, the storage medium may be rewritable (writable) or may be unwritable. Further, the storage medium may be volatile or may be nonvolatile. Further, any method for storing the program code in the storage medium may be adopted, and any shape of the storage medium may be formed.

Examples of the storage medium which satisfies these conditions include: tapes, such as magnetic tape and cassette tape; disks including magnetic disks, such as floppy disks (registered trademark) and hard disk, and optical disks, such as CD-ROMs, magnetic optical disks (MOs), mini disks (MDs), and digital video disks (DVDs); cards, such as IC card (including memory cards) and optical cards; and semiconductor memories, such as mask ROMs, EPROMs, EEPROMs, and flash ROMs. A further example thereof is a memory formed in the computing means such as CPU.

Note that, a program for reading the program code from the storage medium and storing thus read program code into a main memory is stored in the instrument panel image display device in advance by a computer so that the program is executable. Further, in case of distributing the program code to the instrument panel image display device via the communication network, a program for downloading the program code from the communication network is stored in the instrument panel image display device in advance by a computer so that the program is executable.

Further, any program code may be used as the program code as long as the program code instructs the computing means to carry out all the means in the aforementioned processes. Note that, there are some computers each of which has a basic program (for example, an operating system or a library) executable by partially or entirely invoking each process based on the program code in accordance with a predetermined procedure. In this case, as the program code of the instrument panel image display device, it is possible to use a program code whose all procedures are partially or entirely replaced with one or more codes or one or more pointers for instructing the computing means to invoke the basic program.

Further, in the storage medium, an instrument panel image display program is stored so that the program code is disposed in an actual memory. Specifically, the instrument panel image display program is stored so that the computing means accesses the storage medium and executes the program code. Alternatively, the instrument panel image display program may be stored in the storage medium under a condition before the program code is disposed in the actual memory whose medium (for example, hard disk) is always accessable by the computing means. Alternatively, the instrument panel image display program may be stored in the storage medium under such condition that the program code has not been installed from the communication network or a

transportable storage medium to a local storage medium yet.

Further, the instrument panel image display program is not limited to the compiled object code. For example, the instrument panel image display program may be stored in the storage medium as a source code. Alternatively, the instrument panel image display program may be stored as an intermediate code generated during interpretation or compilation.

In any of the foregoing cases, any program code may be used as long as the program code (intermediate code) stored in the storage medium can be converted into a format executable by the computing means.

That is, any program code (intermediate code) may be used as long as the program code is converted into a format executable by the computing means by the following operations: A predetermined format conversion program decompresses a compressed program code, or restores a coded program code, or interprets, compiles, links its source code, or disposes the program code in the actual memory, or executes the program code by combining these processes. On this account, it is possible to obtain the same effect regardless of the storage format in storing the instrument panel image display program in the storage medium.

Note that, the present invention is not limited to the aforementioned embodiment, and can be varied within the scope of

claims. That is, also an embodiment obtained by combining technical means varied within the scope of claims is included in the technical scope of the present invention.

Further, the instrument panel image display device according to the present invention is characterized by further including parameter changing means for changing a value indicated by a parameter which defines a display state of the gauge-like image into other value.

According to this arrangement, the present device can display a gauge-like image whose display state has been set by the user as he or she likes. Thus, it is possible to more freely select a displayed instrument panel image.

Further, the instrument panel image display device according to the present invention is characterized by further including parameter judging means for judging whether the value indicated by the parameter is within a predetermined range or not.

According to this arrangement, the present device can detect, in advance, that a gauge-like image whose display state is inappropriate for the user (for example, a display state which drops the visibility) is included in the instrument panel image.

Further, the instrument panel image display device according to the present invention is characterized in that: in case where the parameter judging means judges that the value indicated by the

parameter is not within the predetermined range, the parameter changing means changes the value indicated by the parameter into a value within the predetermined range.

According to this arrangement, in the present device, a value of the set parameter is limited within the predetermined range without limitlessly having an arbitrary value. Thus, it is possible to change a gauge-like image whose display state is inappropriate for the user (for example, a display state which drops the visibility) into a gauge-like image whose display state is appropriate. For example, when a value range of the parameter is set so that a display state of the gauge-like image can be clearly recognized, it is possible to change the gauge-like image which is hard to recognize into a gauge-like image which can be clearly recognized.

Further, the instrument panel image display device according to the present invention is characterized in that: the parameter defines at least a size and a color of the gauge-like image.

According to this arrangement, the present device can change at least the size and the color of the gauge-like image.

Further, the instrument panel image display device according to the present invention is characterized by further including image data obtaining means for obtaining image data, which codes said other gauge-like image, via a network line, from a server having a storage section which stores the image data.

According to this arrangement, even in case where image data which codes a new selectable gauge-like image is provided, it is possible to easily obtain the data.

Further, the instrument panel image display device according to the present invention is characterized in that: the apparatus is a vehicle, and the instrument panel image includes at least a speedometer image indicative of a running speed of the vehicle as the gauge-like image, and the parameter changing means changes the parameter so that the speedometer image is disposed in front of a driver or in a predetermined position in a visual field of the driver.

According to this arrangement, the speedometer image is disposed in front of the driver or in a predetermined position in a visual field of the driver (a position within a range which has been appropriately determined so as to be within a visual field of the driver: for example, a central position of a dashboard). Thus, the driver can confirm the running speed of the vehicle with minimum movement of his/her visual line.

Further, the instrument panel image display device according to the present invention is characterized by further including parameter changing means for changing a value indicated by a parameter which defines a display state of the background image into other value.

According to this arrangement, the present device can display a background image whose display state has been changed so that the background image is not inappropriately displayed to the user (for example, a display state which drops the visibility of the gauge-like image). Thus, it is possible to more freely select the displayed instrument panel image.

Specifically, as to a general photograph, there is no tendency in color distribution, and there is variation in brightness, contrast, and the like, so that it is difficult to secure the visibility, as compared with an image originally made as the background image of the instrument panel image, even when the color and the size are changed. Therefore, in the present device, in case of using a general photograph as the background image of the instrument panel image, it is possible to secure the visibility by correcting the parameter of the background image. Thus, the user can freely select the background image.

Further, the instrument panel image display device according to the present invention is characterized by further including parameter judging means for judging whether the value indicated by the parameter is within a predetermined range or not.

According to this arrangement, the present device can detect, in advance, that a background image whose display state is inappropriate for the user (for example, a display state which drops

the visibility) is included in the instrument panel image.

Further, the instrument panel image display device according to the present invention is characterized in that: in case where the parameter judging means judges that the value indicated by the parameter is not within the predetermined range, the parameter changing means changes the value indicated by the parameter into a value within the predetermined range.

According to this arrangement, in the present device, a value of the set parameter is limited within the predetermined range without limitlessly having an arbitrary value. Thus, it is possible to change a background image whose display state is inappropriate for the user (for example, a display state which drops the visibility) into a background image whose display state is appropriate. For example, when a value range of the parameter is set so that a display state of the background image can be clearly recognized, it is possible to change the background image which is hard to recognize into a background image which can be clearly recognized.

Further, the instrument panel image display device according to the present invention is characterized in that: the parameter defines at least either a color or luminance of the background image.

According to this arrangement, the present device can change at least either a color or luminance of the background image. For

example, it is possible to improve the visibility by changing the parameter of the background image data as follows.

(1) A color mainly used in the background image is used to monotonize the background image. This prevents the coloring of the background image from being diffusive. Thus, it is possible to most clearly distinguish the coloring of the gauge-like images, thereby improving the visibility.

(2) The background image is monotonized with a color which is not used in the gauge-like image. This prevents the coloring of the background image from being diffusive. Thus, it is possible to most clearly distinguish the coloring of the gauge-like images, thereby improving the visibility.

(3) An inappropriate combination of a standard color used to monotonize the background image and a letter color of the gauge-like image is forbidden in advance. On this account, it is possible to determine the standard color so that recognition of important letter information in the instrument panel image is not prevented. Thus, it is possible to most clearly distinguish the coloring of the gauge-like images, thereby improving the visibility.

(4) The correction is made so as to drop the luminance of the background image so that average luminance of the background image is lower than average luminance of the gauge-like image by not less than a predetermined value. On this account, it is possible

to make the gauge-like image brighter than the background image by not less than predetermined luminance, thereby improving the visibility.

Further, the instrument panel image display device according to the present invention is characterized in that: the parameter changing means changes a parameter of at least either the gauge-like image or the background image so that a periphery of the gauge-like image is bordered.

According to this arrangement, the present device can border a periphery of the gauge in the instrument panel image. Thus, the visibility of the gauge is improved. Further, even in case of dropping the luminance of the background image in order to improve the visibility of the gauge-like image, the border enables the luminance correction value of the background image to be reduced. As a result, it is possible to use a background image more similar to an original image.

Further, the present invention may be realized as a server-client type system. In this case, an instrument panel image changing system is constituted of the instrument panel image display device and the server for providing image data, which codes the other gauge-like image, to the device.

A vehicle according to the present invention is characterized by including the instrument panel image display device of the

present invention. According to this arrangement, it is possible to provide a vehicle including the instrument panel image display device which can more freely change the instrument panel image.

Note that, the instrument panel image display device may be realized by a computer. In this case, the present invention includes: an instrument panel image display program for causing a computer to realize the instrument panel image display device by causing the computer to operate as the foregoing means; and a computer-readable storage medium which stores the instrument panel image display program.

As described above, the instrument panel image display device of the present invention changes each image data, which codes a gauge-like image included in the instrument panel image, into image data, which codes other gauge-like image, or changes each image data, which codes a background image, into image data, which codes other background image, or carries out both the operations, so that it is possible to more freely select the instrument panel image with the visibility of gauges taken into consideration.

INDUSTRIAL APPLICABILITY

The present invention is applicable to an image display device, installed on a transportation apparatus such as an automobile

provided with gauges or a general apparatus such as a control apparatus provided with a control panel, whose display image design can be changed.